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Development of Digital Transformation Management Scale: Validity and Reliability Study

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Annotation. This study develops and validates the Digital Transformation Management Scale to assess teachers' perceptions of digital transformation in education. Findings reveal a three-factor structure with high reliability. The scale provides a valid tool for evaluating digital transformation management and supporting evidence-based practices.

Keywords: *digital transformation, digital transformation management, digital transformation in education.*

Introduction

Education plays a fundamental role in providing individuals with the knowledge, skills, attitudes, and values that will enable them to both contribute to and benefit from an inclusive and sustainable future. In the coming years, it will be critical to be able to set clear and goal-oriented objectives, work in collaboration with individuals with different perspectives, explore untapped opportunities, and generate multi-faceted solutions to complex problems. In this context, education should not only prepare individuals for

business life but also aim to raise them as active, responsible, and responsive citizens (OECD, 2018). Today, as in every field, traditional systems are being replaced by modern systems. Organizations operate in an environment where digital technologies are becoming more and more decisive, and these technologies are becoming essential components of products, services, and operations (Yoo et al., 2012). However, Balkin and Sonnevend (2016) state that the traditional education model is structured based on spatial and temporal limitations, while digital networks eliminate these limitations, allowing teachers to access more students with geographical independence and reducing the need for physical resources.

In recent years, the concept of digital transformation has gained an important position as one of the key factors influencing the development and sustainability of contemporary organizations. The integration and exploration of new digital technologies stand out as one of the biggest challenges facing organizations. This transformation has a significant impact on all sectors and organizations (Rêgo et al., 2021). In the post-pandemic period, life has been reshaped in the digital environment, which has affected many areas, especially education and learning processes (Ahmad et al., 2023). In the post-COVID-19 era, societies were defined by their responses to these conditions rather than the conditions they face. The pandemic has provided an opportunity for new beginnings and transformation in education, revealing the need to develop strong structures where online and face-to-face learning can be blended in a more balanced way. This process also contributed to the visibility of problems in existing education systems (Fischer et al., 2020). In this context, Poddenezhnyi (2021) states that with the COVID-19 pandemic, the spread of digital education and digital transformation management is an inevitable necessity in education. In order to gain a competitive advantage in the post-pandemic period, educational institutions need to develop effective and sustainable digital strategies.

The world we live in is changing rapidly, and this change is leading to significant transformations in what is taught in education and how it is taught. The question of how education systems can be restructured to foster a learner-centered approach while adapting to the increasing demands of the twenty-first century has been raised (Mohamed Hashim et al., 2022). Fischer et al. (2022) argue that traditional school practices, such as students sitting still and passively listening to teacher lectures, memorizing information presented by teachers or textbooks, and repeating this information on exams, are considered functional in the context of a world where change is not constant, coverage of core subjects is considered sufficient, and acquired skills remain relevant throughout life. However, while the researchers do not characterize these practices as completely meaningless, they state that these approaches fall short of meeting today's educational needs.

While the term *digital transformation* is common in industry, it is only now emerging in education. This shows that the industry is making progress and education can benefit

from this progress (McCarthy et al., 2023). Digital transformation is the use of new technologies such as mobile, artificial intelligence, cloud, blockchain, and Internet of Things (IoT) to increase user satisfaction, streamline business processes, and develop new business models (Warner & Wäger, 2019). Digital technologies are considered as tools that support this process without interfering with human goals, objectives, and outcomes in education. Accordingly, individuals perceive digital technologies mostly as auxiliary tools that fulfill certain functions (Lund & Aagaard, 2020). In the so-called digital age, there is a basic assumption that digitalization has brought about a rapid and radical change in schools, education, and society. However, the biggest challenge for educational research is to clearly define what exactly digitalization means (Pettersson et al., 2023). McCarthy et al. (2023) state that digital transformation in education is about preparing for future innovations and challenges, as well as redesigning how to bring people, data, and processes together to create better environments for students, educators, parents, and system leaders in today's digital-first world (Siljebo, 2020). Digitalization in schools refers to the use of digital technologies within school structures to support learning and development processes. The transformation caused by this digitalization process refers to the restructuring of business activities carried out in school organizations in line with common goals. School organizations are complex and object-oriented systems in which these activities are carried out. McCarthy et al. (2023) argue that for this transformation to be effective, school leaders need to have a clear understanding of why digital innovations are critical. This process encompasses many dimensions, such as infrastructure, curriculum, assessment, human resource development, and financing.

The digital age greatly increases opportunities and supports the need to make learning a part of life (Fischer et al., 2022). Although there are numerous scientific studies on the digitalization of education, the vast majority of them focus on the technological tools and methodology of this process, while the issue of managing digital transformation in education is under-researched (Poddenezhnyi, 2021). In this context, it is stated that school transformation is not possible without mindset transformation in relation to digital transformation (Fischer et al., 2022). Leaders are aware of the necessity of digital transformation in order to share information, services and experiences effectively and efficiently. The global pandemic has led to the restructuring of society and revealed the advantages of the flexible nature of digital technologies. In this process, educational leaders and policy makers need to develop a systemic approach to manage the transformation enabled by digital innovations, while decision makers in different sectors are seeking greater clarity on the digital transformation process (McCarthy et al., 2023). To guide digital transformation in education, UNESCO has developed a framework based on a three-stage maturity model. This model, which consists of development, progress and transformation stages, helps countries assess their digital transformation processes, identify their strengths and weaknesses, and create strategic visions. The

framework can be used by all stakeholders and is adaptable to each country's specific circumstances. It also guides the planning, implementation and sustainability of digital transformation by promoting an approach that is in line with global standards (UNESCO, 2024). The three-stage model developed by UNESCO is thought to bring a systematic approach to the digital transformation process in education, enabling countries to analyze their current digital capacity and develop goal-oriented strategies accordingly. This model will serve as a guiding tool for all stakeholders involved in the transformation process and will also support the development of sustainable and context-sensitive digital education policies.

One of the most important responsibilities of managers in digital transformation is to lead the process with a holistic approach. This means ensuring that all systems work in harmony, making education processes more efficient, communicating clearly and effectively with stakeholders, and carefully monitoring and evaluating the transformation process (Poddenezhnyi, 2021). For the digital transformation of education, a gradual and long-term system-oriented strategy should be adopted. These strategies should be supported by evidence and developed in a continuous and structured way by multiple ministries, stakeholders and educators (UNESCO, 2024).

The digital transformation process has progressed rapidly across the world, and the education sector has been significantly affected by this process. Especially the COVID-19 pandemic, which started in March 2020, accelerated the digitalization process in educational institutions and deepened the structural changes in the sector. While the effective use of digital tools during the pandemic period ensured the continuity of education, it also made the shortcomings and challenges in digital transformation strategies visible. In this context, educational institutions need to develop digital transformation strategies against the problems they may face in the future and plan their management processes accordingly. It is critical for the success of the transformation that educational administrators take an active role in all stages of the digital transformation process and develop strategies suitable for the unique conditions of each institution.

Objective

Digital transformation management plays a critical role in aligning educational policies and strategies with digital tools and methods. In this context, the Digital Transformation Management Scale is expected to contribute to understanding the effectiveness of digital transformation strategies in education by evaluating teachers' perceptions of the digital transformation process. This study aims to provide a road map for educational administrators and to develop a scale applicable to teachers in order to contribute to more efficient management of the digital transformation process. With

the scale developed in this context, it is aimed to raise awareness about the difficulties encountered in the digital transformation process and to increase the ability to produce solutions. In addition, it is expected to provide data-based contributions to the strategic decision-making processes of administrators and stakeholders. In this context, when the existing literature is examined, there are scales related to digital transformation. These scales are: Digital Transformation Scale (Sağlam, 2021), Awareness Scale on Digital Transformation in Education (Yurdakal, 2023), Digital Transformation Maturity Model (Özdemir, 2023). These scales do not include a scale for digital transformation management.

Method

Working group

The study group of this study consists of 650 teachers working in official middle and high schools affiliated with the Istanbul Provincial Directorate of National Education. The sample was selected by a simple random sampling method. In simple random sampling, each individual has an equal probability of being selected from the population. The aim is to select individuals who represent the population, and the possibility of bias is almost negligible (Creswell, 2012). In the exploratory factor analysis (EFA) stage of the study, 330 teachers were included, and in the confirmatory factor analysis (CFA) stage, 320 teachers were included. Demographic information of the participants is given in Table 1.

Table 1
Demographic Characteristics of Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) Participants

Features		AFA		DFA	
		f	%	f	%
Gender	Woman	219	66.4	233	72.8
	Male	111	33.6	87	27.2
Age	30 and below	25	7.6	29	9.1
	31–40	150	45.5	153	47.8
	41–50	129	39.1	103	32.2
	51 and above	26	7.9	25	7.8

Features		AFA		DFA	
		f	%	f	%
Education Status	License	250	75.8	260	81.3
	Master's Degree	76	23.0	57	17.8
	PhD	4	1.2	3	0.9
Mission	Teacher	320	97.0	313	97.8
	Assistant Director	9	2.7	5	1.6
	Director	1	0.3	2	0.6
Working time	1-5 years	140	42.4	153	47.8
	6-10 years	100	30.3	93	29.1
	11-15 years	71	21.5	49	15.3
	16 and above	19	5.8	25	7.8
Professional working time	1-5 years	29	8.8	42	13.1
	6-10 years	52	15.8	75	23.4
	11-15 years	98	29.7	76	23.8
	16 and above	151	45.8	127	39.7
Type of institution	Middle School	224	67.9	214	66.9
	Imam Hatip Secondary School	33	10.0	33	10.3
	Anatolian High School	14	4.2	35	10.9
	Vocational and Technical Anatolian High School	39	11.8	37	11.6
	Anatolian Imam Hatip High School	19	5.8	1	0.3
	Science High School	1	0.3	0	0.0
The general socio-economic status of the students studying at your institution	Low	50	15.2	72	22.5
	Below middle	79	23.9	95	29.7
	Middle	181	54.8	138	43.1
	Above medium	19	5.8	14	4.4
	High	1	0.3	1	0.3

Table 1 presents the demographic characteristics of the participants in the EFA and CFA stages of the digital transformation management scale development study. EFA and CFA studies were conducted with 330 and 320 teachers, respectively. When the gender variable is analyzed, 66.4% of the EFA group and 72.8% of the EFA group

consisted of female participants. The age distribution of the participants was largely in the 31–40 age range in both groups, increasing from EFA (45.5%) to CFA (47.8%). Regarding the level of education, it is seen that in both samples, bachelor's degree graduates are predominantly included in EFA (75.8%) and EFA (81.3%). When the task distribution of the participants is evaluated, it is seen that in both EFA and CFA samples, the majority of the participants are teachers in EFA (97.0%) and CFA (97.8%) and the number of participants at the administrator level is quite limited. In terms of tenure, the highest rate in the EFA group belongs to teachers between 1–5 years with 42.4%, while this rate is 47.8% in the EFA group. In terms of professional seniority distribution, 45.8% of the EFA group had 16 years of experience and above, while this rate was 39.7% in the EFA group. In terms of the type of institution where the participants work, the highest rate in both groups belongs to secondary school teachers in EFA (67.9%) and EFA (66.9%). Other school types include Imam Hatip Secondary Schools, Vocational and Technical Anatolian High Schools, and Anatolian High Schools. Finally, when the perceptions of students' socio-economic level were evaluated, the majority of both groups evaluated the student profiles at the "medium" socio-economic level EFA (54.8%) and CFA (43.1%). These findings support the demographic diversity of the samples used in the scale development process and the applicability of the developed scale to teacher groups with different characteristics.

Scale Structure

The developed scale has a 5-point Likert-type rating. The items in the scale are: "Strongly disagree = 1", "Disagree = 2", "Undecided = 3", "Agree = 4", "Strongly agree = 5". An increase in the scores obtained from the scale indicates that individuals have a high level of agreement with the relevant statement, while scores approaching one indicate a low level of agreement.

Scale development process

As a result of the data obtained from the interviews, it is aimed to develop a quantitative data collection tool: "Digital Transformation Management Scale". While developing the scale, the following steps will be followed (Kartal & Bardakçı, 2018; Tavşancıl, 2014):

- Creation of an article repository;
- Submission of the item pool to expert opinion to examine the content validity;
- Clarity of the statements in the item pool;
- Presenting the draft scale to language experts to evaluate its conformity with language rules, applying the draft scale to the study group;
- Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to evaluate the construct validity of the scale;

- Item analysis, evaluation of the reliability of the scale in the context of test-retest application;
- Calculation of Cronbach's alpha internal consistency coefficient for the reliability of the scale.

In this study, a measurement tool was developed to measure teachers' perceptions of digital transformation management. The scale development process was carried out with a multi-stage approach, including literature review, qualitative data analysis, item writing, content validity studies, pre-application, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA).

First, a literature review on digital transformation, digital leadership, digital transformation strategies, and managerial support was conducted. The theoretical information obtained was combined with the findings obtained from the interviews with teachers and experts in the qualitative dimension of the research, and contributed to the creation of the scale items. The 28-item draft scale form developed in this process was submitted to the opinions of academicians who are experts in the field of measurement and evaluation and educational technologies; necessary arrangements were made in terms of content on the item form, evaluated in terms of content validity. After the expert opinions, a preliminary application was conducted with a limited number of participants to evaluate the comprehensibility of the scale and necessary simplifications were made in terms of linguistic terms. Then, data were collected with a study group of 330 teachers for the EFA application. As a result of the EFA, 8 items with low factor loadings and damaging the structural integrity of the scale were removed from the scale and a three-factor and 20-item structure was obtained as a result of the analysis. In order to test the construct validity of the scale, CFA was applied with the data obtained from 320 teachers independent from the sample in which EFA was conducted. The CFA analyses were conducted using AMOS 23 software, and the three-factor structure of the scale was confirmed. In this analysis process, two more items that were determined to have a negative effect on the fit indices of the model were removed, and the scale was reduced to 18 items in its final form. These factors were named as "Support from School Administration", "Access to Digital Tools and Infrastructure", and "Support from Central Administration". Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were applied to ensure construct validity, and Cronbach Alpha internal consistency coefficient was calculated to ensure reliability.

Findings

EFA Findings

In the scale development process, one of the most widely used statistical methods to reveal the dimensional structure of the construct to be measured is factor analysis. Factor analysis is a statistical method that aims to create fewer and meaningful factors by bringing together a large number of variables that measure similar information (Büyüköztürk, 2002). Factor analysis is a statistical analysis method used to determine whether the variables in a data set form relatively independent and consistent subgroups and factors (Tabachnick & Fidell, 2020). After factor analysis is applied, the factors obtained are conceptually defined by taking into account the content of the loaded items, and thus, the psychological or structural dimensions represented by each factor are determined. DeVellis, 2014). In this study, firstly, exploratory factor analysis was performed on the data obtained from 330 participants in order to determine the measurement structure of the scale.

In order to apply Exploratory Factor Analysis (EFA) to a data set, it is first assessed whether the sample size is sufficient. One of the basic statistics used for this purpose is the Kaiser-Meyer-Olkin (KMO) coefficient. The KMO value indicates the suitability of the data for factor analysis. Kaiser states that this value is excellent if it is 0.90 and above, very good if it is around 0.80, adequate if it is between 0.70 and 0.60, and values below 0.50 are considered insufficient (Tavşancıl, 2014). At this stage, the KMO statistic for the data of the 28-item draft scale was calculated as 0.947. Accordingly, it was determined that the sample size was perfectly adequate for factor analysis. Another test required for applying EFA to the data set is Bartlett's sphericity test. Before applying factor analysis, it should be evaluated whether the data show a normal distribution. This assumption is valid both for each variable and for all linear combinations of these variables. Whether the data are suitable for a multivariate normal distribution is examined by Bartlett's test of sphericity. A significant result of Bartlett's test indicates that the data are suitable for factor analysis and that there is a sufficient level of relationship between the variables (Tavşancıl, 2014). As a result of the analysis of the draft scale, it was determined that there were high and significant relationships between the variables and the assumption of sphericity was met ($\chi^2 = 3802.661$; $p < 0.001$).

In order to determine the factor structure of the Digital Transformation Management Scale, EFA was applied to 28 items in the draft scale using Principal Component Analysis and Varimax Rotation methods. The items that did not fit under any factor and whose factor loadings were very close in two or more factors, and which could be characterized as overlapping were identified and removed from the scale. In this way, EFA was applied for the last time to the remaining 20 items by removing 8 items from the scale, and the results in the relevant table were obtained (Table 2).

Table 2

Exploratory Factor Analysis Results

Scale Subdimension	Items	Fak. Load Value	Eigenvalue	Variance (%)	Cumulative Variance (%)
Factor 1	Items 25	0.758	9.424	47.118	47.118
	Items 24	0.750			
	Items 23	0.737			
	Items 11	0.696			
	Items 7	0.683			
	Items 27	0.680			
	Items 14	0.579			
Factor 2	Items 4	0.786	1.755	8.776	55.894
	Items 3	0.747			
	Items 5	0.690			
	Items 8	0.639			
	Items 6	0.583			
	Items 2	0.582			
	Items 17	0.560			
Factor 3	Items 21	0.711	1.016	5.081	60.974
	Items 20	0,705			
	Items 13	0,643			
	Items 19	0,627			
	Items 22	0,620			
	Items 16	0,525			

One of the most common methods for estimating the number of factors is to examine the eigenvalues obtained in principal component analysis. Eigenvalues indicate the total variance explained by each component. Since the contribution of each variable is considered to be 1 in standardized data, components with eigenvalues below 1 are generally not considered significant (Kaiser Criterion). The higher the eigenvalue, the higher the variance explained by the factor (Tabachnick & Fidell, 2020).

As seen in Table 2, as a result of EFA, 3 sub-dimensions with eigenvalues greater than 1 were obtained according to the Kaiser criterion. Another important criterion in determining the number of sub-dimensions in the scale and ensuring construct validity is the total variance explained. Considering the variance explained values in

Table 1, it is seen that the 3-factor structure explains 60.974% of the total variance. The variance explained by the factors is 47.118% for Factor 1, 8.776% for Factor 2, and 5.081% for Factor 3, respectively.

Factor loading is a coefficient that shows the relationship between items and a particular factor. Each item is expected to show a high loading value on the factor in which it is located. A group of items that have a strong relationship with a factor indicates that those items measure the same concept or construct. For example, a factor loading of 0.3 for a variable indicates that the variance explained by the factor is 9%. This level of variance is noteworthy. In general, loadings of 0.60 and above are considered high, while loadings between 0.30–0.59 are considered moderate and are taken into account in variable extraction. Factor loadings can also be evaluated for statistical significance as a correlation coefficient. However, it should be kept in mind that low correlations are more likely to be significant as the sample size increases (Kline, 1994; cited in Büyüköztürk, 2002). When Table 2 is examined, it is seen that the factor loadings of the items vary between 0.525–0.787. Accordingly, it can be said that the factor loadings of each item in the 3-factor model are quite high and sufficient.

CFA Findings

In order to examine the validity of the measurement structure of the digital transformation management scale, consisting of 3 sub-dimensions and 20 items as a result of EFA, CFA was applied to the data obtained from another independent sample of 320 participants using AMOS 23 package program. Whether the measurement model established as a result of CFA is compatible with the data is determined with the help of fit indices. In the literature, values such as χ^2/sd, GFI, CFI, TLI, IFI, RMSEA, etc. are widely used. The critical values that these indices should provide are as shown in Table 3 (Çokluk et al., 2018).

Table 3
Critical Values for Fit Indices

Compliance Indices	Good Fit	Acceptable Compliance	Coefficient Calculated for the Model
χ^2/sd	≤ 3	≤ 5	2.640
GFI	≥ 0.90	≥ 0.85	0.895
IFI	≥ 0.95	≥ 0.90	0.937
TLI	≥ 0.95	≥ 0.90	0.927
CFI	≥ 0.97	≥ 0.95	0.937
RMSEA	≤ 0.05	≤ 0.08	0.072
SRMR	≤ 0.05	≤ 0.08	0.054

As a result of CFA, the fit index values of the model were calculated as $\chi^2/df = 2.640 < 3$; $0.90 < GFI = 0.895$; $0.95 < IFI = 0.937$; $0.90 < TLI = 0.927$; $0.95 < CFI = 0.937$; $RMSEA = 0.072 < 0.08$ and $SRMR = 0.054 < 0.08$, respectively. When these values are compared with the critical values in Table 2, it is seen that the model shows a good fit to the data according to χ^2/sd, GFI and IFI indices, and an acceptable fit according to TLI, CFI and RMSEA indices. According to these findings, the validity of the 3-subdimensional measurement structure revealed by EFA was confirmed on an independent sample.

Another important point is that regression coefficients should be significant in CFA. Regression values express the predictive power of the items on the factors, in other words, factor loadings (Karagöz, 2016). Factor loadings of 0.40 and above indicate that the relevant items adequately represent the factor (Şencan, 2005). In this context, all of the regression coefficients for each item were found to be significant (Table 4).

Table 4

Standard Regression Coefficients of the Items at the End of CFA

No	Articles	School Management Support	Access to Digital Tools and Infrastructure	Central Government Support
Items 14	School management cares about teachers' contributions to the digital transformation process.	0.735		
Items 27	In the digital transformation process at our school, effective coordination is ensured between the central administration and the school administration.	0.809		
Items 7	Teachers' participation in digital transformation processes is actively encouraged at our school.	0.678		
Items 11	The digital transformation process is regularly monitored by the school management.	0.705		
Items 23	School management provides guidance to teachers on digital transformation.	0.808		
Items 24	School management provides opportunities to increase teachers' digital skills.	0.833		
Items 25	In our school, there is an open communication between the school management and teachers during the digital transformation process.	0.779		

No	Articles	School Management Support	Access to Digital Tools and Infrastructure	Central Government Support
Items 2	Teachers in our school are able to use digital tools effectively in their lessons.		0.64	
Items 8	Digital transformation in our school contributes positively to the professional development of teachers.		0.615	
Items 5	In our school, teachers do not face any obstacles in accessing digital tools.		0.792	
Items 3	Digital infrastructure (internet, computers, software, hardware) is sufficient in our school.		0.772	
Items 4	I can diversify the course materials by using digital tools in our school.		0.748	
Items 16	Our school has adequate security measures for online environments.			0.625
Items 22	Regular communication between the school management and the central administration is ensured during the digital transformation process at our school.			0.818
Items 19	In our school, the central administration provides adequate guidance to teachers in the digital transformation process.			0.797
Items 13	The central government provides our school with sufficient financial resources for the digital transformation process.			0.648
Items 20	The staff required for the successful implementation of the digital transformation process in our school is sufficient.			0.757
Items 21	I think that the policies determined by the central government are applicable in digital transformation processes.			0.804
	AVE	0.59	0.51	0.56

As seen in Table 4, the standard factor loadings of all items are greater than 0.40 and are acceptable values in terms of the construct validity of the scale.

Another important indicator in assessing the validity of a scale is the AVE (Average Variance Explained) values of the factors. If the AVE value is greater than 0.5, the factor is considered to have convergent validity. AVE value is obtained by dividing the sum of the squares of the covariances (loadings) of the statements belonging to the factor by the number of statements. This evaluation is made separately for each factor (Yaşlıoğlu, 2017). AVE is the average value of the total variance of a factor explained by the measurement instruments belonging to that factor. In other words, AVE indicates the common variance of a factor and the expressions belonging to that factor. The AVE value is often used to assess the construct validity of the factor and how reliable the measurement instrument is. When the AVE value is 0.5 or greater, the factor is considered to have achieved convergent validity (Fornell & Larcker, 1981). As seen in Table 3, the AVE values of the factors were calculated as 0.59 for the "school administration support" sub-dimension, 0.51 for the "access to digital tools and infrastructure" sub-dimension and 0.56 for the "central administration support" sub-dimension. It is seen that the AVE values of all factors are greater than 0.50. It can be said that these findings are an important indicator that the scale has construct validity.

Internal Consistency Analysis

Significant correlation coefficients between the total scores of the items or sub-dimensions in the measurement tool and the total scores of the scale are accepted as an indicator of internal consistency. If the items generally discriminate in the same direction, this indicates that the instrument has high internal consistency and provides valid evidence for construct validity. If the correlation coefficient is negative, zero, or close to zero, this indicates that the item does not adequately or not at all measure the attitude to be measured by the other items. Since such items may negatively affect the validity and reliability of the scale, it is stated that such items should be removed from the scale (Tavşancıl, 2014).

Cronbach's alpha coefficient is one of the most preferred methods for determining the internal consistency of a scale or test. A high Cronbach's alpha coefficient indicates that the items in the test are more consistent with each other and measure the same construct. Generally, Cronbach's alpha value of 0.70 and above is considered sufficient for the scale to be considered reliable (Kartal & Dirlik, 2016). The reliability of the Digital Transformation Management Scale based on internal consistency was first examined by calculating the Cronbach α coefficients of the overall scale and its sub-dimensions with the help of the data obtained from 330 people reached during the item analysis phase.

Table 5
Cronbach's α Coefficients of the Scale and Its Sub-Dimensions

Factors	Number of Items	Cronbach α Value
1	7	0.907
2	5	0.837
3	6	0.878
Total	18	0.942

According to the results in Table 5, the values obtained are greater than .70 and are sufficient for the reliability of the scale. First sub-dimension: It consists of 7 items and shows a very high Cronbach α value of 0.907. This indicates that the subscale has a high level of internal consistency. Second sub-dimension: It consists of 5 items, and Cronbach's α value was found to be 0.837. This value also indicates a high level of reliability. Third sub-dimension: It consists of 6 items, and Cronbach's α coefficient was calculated as 0.878. This value indicates a strong internal consistency in this sub-dimension of the scale. The whole scale consists of 18 items, and Cronbach's α value was calculated as 0.942. This high value indicates that the scale as a whole is highly reliable.

Discussion and Conclusion

In this study, 330 teachers participated in the EFA phase, and 320 teachers participated in the CFA phase. Considering the explained variance values of the Digital Transformation Management Scale, it is seen that the 3-factor structure explains 60.974% of the total variance. The variance ratios explained by the factors are 47.118% for "School Management Support", 8.776% for "Access to Digital Tools and Infrastructure", and 5.081% for "Central Administration Support". In addition, it was seen that the factor loadings of the Digital Transformation Management Scale ranged between 0.525 and 0.787, thus all items were sufficiently related to the factors. In order to support construct validity, CFA was applied to the independent data set obtained from 320 teachers. Whether the measurement model established as a result of CFA is compatible with the data is determined with the help of fit indices. In the literature, values such as χ^2/sd, GFI, CFI, TLI, IFI, RMSEA, etc. are widely used (Çokluk et al., 2018). During the analysis process, 2 more items that were determined to have a negative effect on the fit indices of the model were removed, and the scale was reduced to 18 items in its final form. The fit indices obtained as a result of CFA show that the model fit of the scale is acceptable and good. The results of this study show that the developed Digital Transformation Management Scale is a valid and reliable measurement tool for measuring teachers' perceptions towards the management of digital transformation.

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Skaitmeninės transformacijos valdymo skalės plėtojimas: validumo ir patikimumo tyrimas

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Santrauka

Šio tyrimo tikslas – patvirtinti skaitmeninės transformacijos valdymo skalę (angl. *Transformation Management Scale*), skirtą vertinti mokytojų požiūrį į skaitmeninę transformaciją švietimo srityje. Duomenys tyrimui buvo surinkti iš 650 mokytojų, taikyta paprasta atsitiktinė atranka; 330 dalyvių buvo įtraukti į tiriamąją faktorinę analizę, o 320 – į patvirtinamąją faktorinę analizę. Atlikus analizes buvo patvirtinta trijų faktorių struktūra: mokyklos vadovybės parama, prieiga prie skaitmeninių priemonių ir infrastruktūros bei centrinės administracijos parama. Baigiamoji skalė buvo sudaryta iš 18 punktų. Sukurta skalė parodė priimtinus tinkamumo indeksus ir aukštą patikimumą. Iš tyrimo rezultatų matyti, kad skalė yra validus ir patikimas instrumentas skaitmeninės transformacijos valdymui švietimo kontekste vertinti.

Esminiai žodžiai: *skaitmeninė transformacija, skaitmeninės transformacijos valdymas, skaitmeninė transformacija švietimo srityje.*

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